

Plein écran

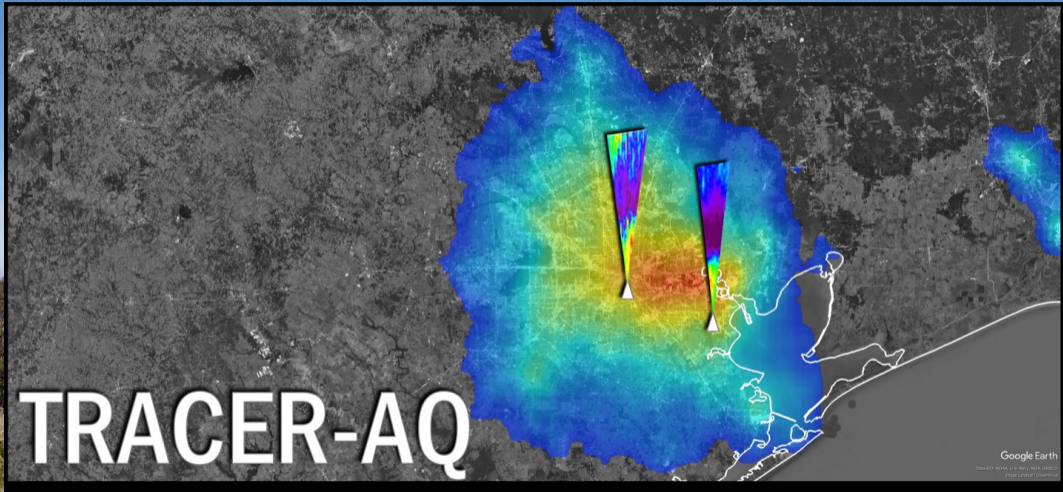
Observation of O3 events with LMOL during the TRACER-AQ campaign

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Houston, NASA LaRC), J. Sparrow (NASA LaRC)
LMOL, part of the TOLNET project is funded by NASA

January 2022



The TRACER-AQ Campaign



The TRACER-AQ Campaign

Objectives of the TRacking Aerosol Convection ExpeRiment – Air Quality campaign)

Per the website

- Ozone Photochemistry and Meteorology
- Modeling and Satellite Evaluation
- Intersection of Air Quality and Socioeconomics Factors

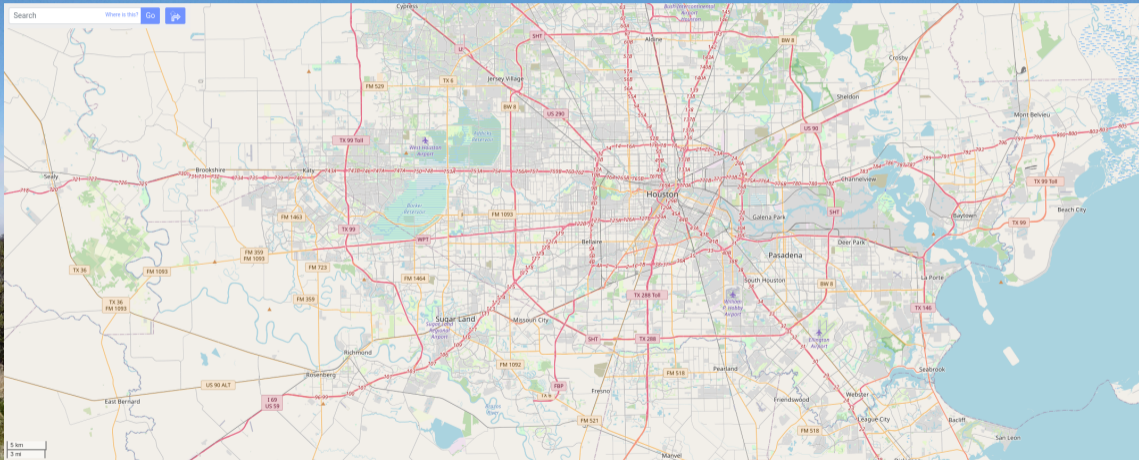
TOLNET Lidar role for observations

- Supports the O₃ observations at the University of Houston and Galveston
- Provides vertical profiles
- Provide long-duration observations

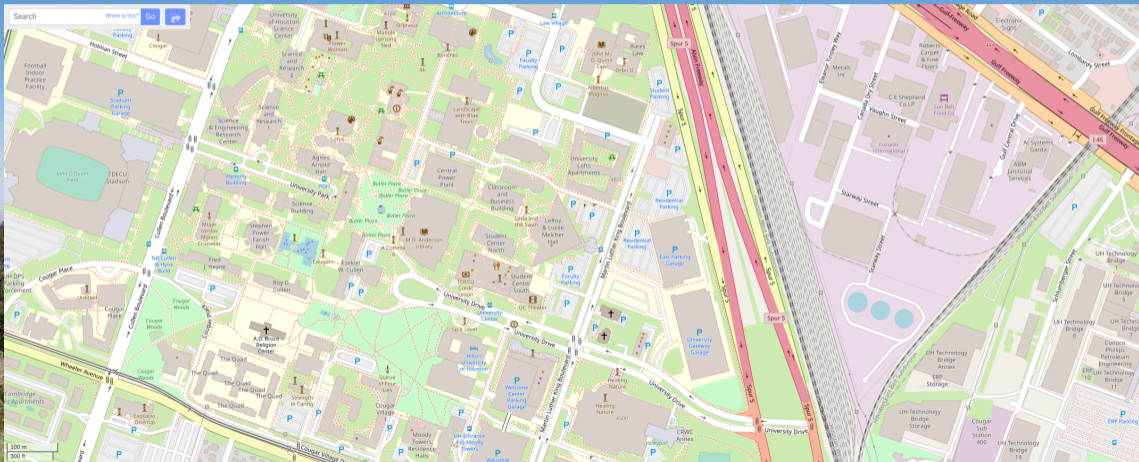
Langley Mobile Ozone Lidar: supporting the University of Houston site

- Located at the University of Houston
- Near the Launch trailer and the Moody tower AQ sensors including PANDORA
- Supported by UAV (drone) and ozonesondes

The TRACER-AQ Campaign



The TRACER-AQ Campaign



The Langley Mobile Ozone Lidar (LMOL)

LMOL

- Mobile Lidar for Aerosols and O₃ measurements, part of the TOLNet network.
- Inputs parameters, outputs parameters, uncertainty validation, etc, validated by the network.
- Adapted to study evolution of O₃.
- Available to support calibration/validation of satellites (TROPOMI, TEMPO)
- Adaptable
- Strong collaboration with Pandora / measurements complementary.
- 2018 campaigns. OWLETS-2 / LISTOS improved the understanding of coastal environment

The Langley Mobile Ozone Lidar (LMOL)

Unique LMOL capabilities

- Mostly Autonomous
- Typical resolution: 5 min, 20 m – 1000 m (vertical).
- Capabilities: 100m – 6/7 km altitude (day), 10 km (night)...and improving!
- Smallest TOLNet Lidar / most mobile.
- EYE SAFE!

LMOL can be shipped internationally for campaigns

It is based on published laser/techniques, and therefore not a problem for export.

Observation statistics of LMOL during the campaign

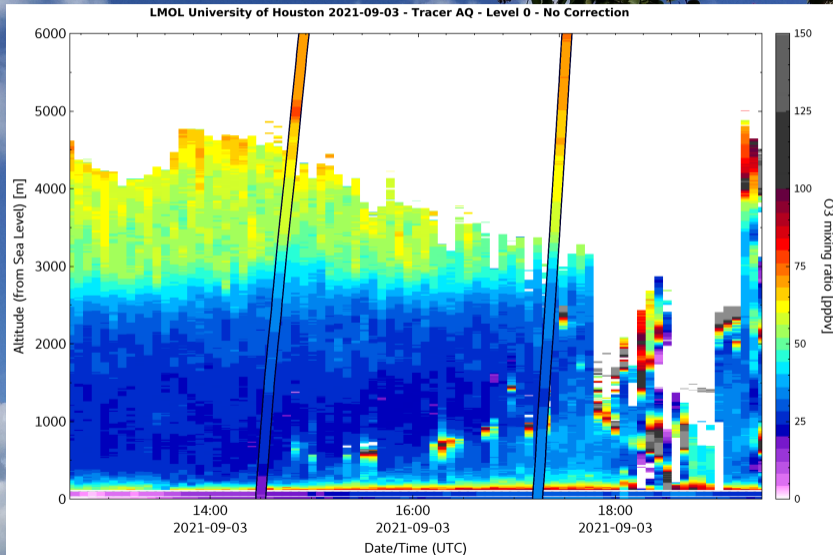
Observation days

- 228 hours of operation (stopped when cloudy / no action day)
- August – 26 – 27 – 29 – 30
- September – 1 – 3 – 6 – 7 – 8 – 9 – 10 – 11 – 12 – 18 – 20 – 21 – 22 – 24 – 25 – 26 – 27
- Data available on <https://www-air.larc.nasa.gov/cgi-bin/ArcView.1/TOLNet?NASA-LARC=NASA-LARC>

Ozonesonde comparisons at LMOL

- 1 on September 1 and 27
- 2 on September 3 – 9 – 10 – 11 – 25 – 26 – 27

Quiet days: the case of September 03 – Realtime image

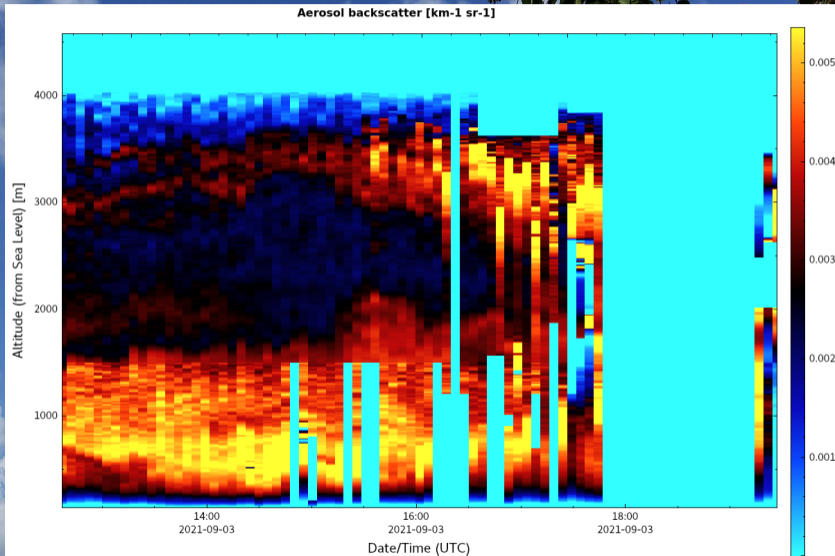


Quiet days: the case of September 03 – Realtime image

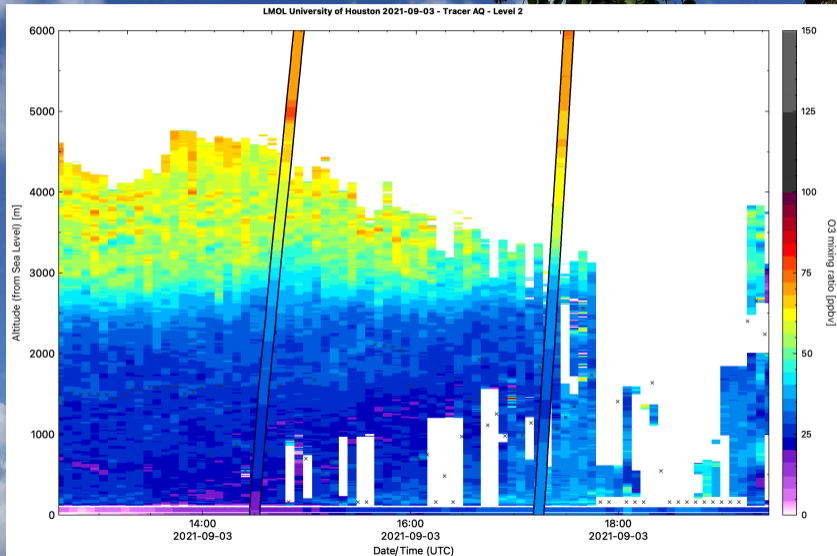
Analysis

- The realtime system was working, with the tower and launch trailer giving the lower bins
- Two ozonesondes we launched with excellent comparison with the lidar above 300m altitude
- Below 200m altitude, the non-aerosol corrected curtain reports higher than expected values
- This discrepancy only appears on some days, otherwise, the tower and the lidar are very close in value
- Potential causes: AEROSOLS, trace gases interferences, alignment error (we usually clear those)
- We rarely observe high levels of aerosols at Hampton, Va. We decided to investigate that problem

Quiet days: the case of September 03 – UV channel Aerosol



Quiet days: the case of September 03 – Aerosol corrected data



Quiet days: the case of September 03 – Aerosol corrected data

Analysis

- The aerosol correction is mandatory for an accurate view on some days
- There is unfortunately some drawbacks on that correction

Problems with the aerosol estimation from the UV channel

- The backscatter-to-extinction ratio (i.e. Lidar Ratio) needs to be estimated
- No estimation in highly polluted / dynamic environment at our wavelength

Problems with the correction of O₃ when the aerosol density is correctly retrieved

- The aerosol Angström coefficient in the 286-292nm should be estimated
- Specific α extinction coefficient should be estimated

3 parameters should be estimated for a good correction!

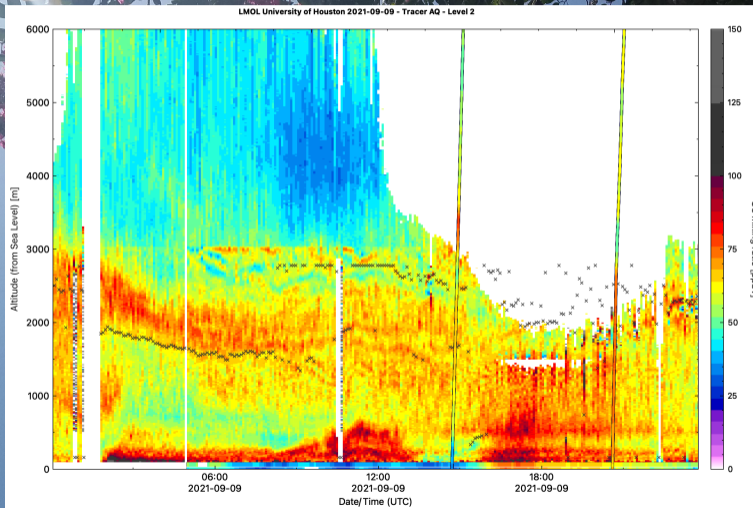
L. Lei has just submitted a paper on the problem

Additional product

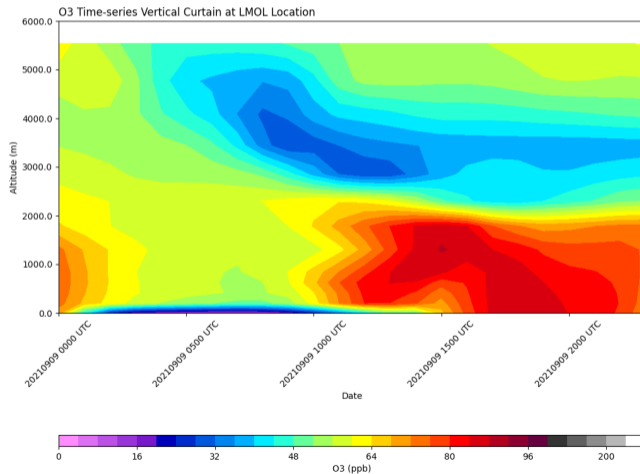
An aerosol boundary layer product is released.

(It can be generalized as a layer height product and help clear clouds)

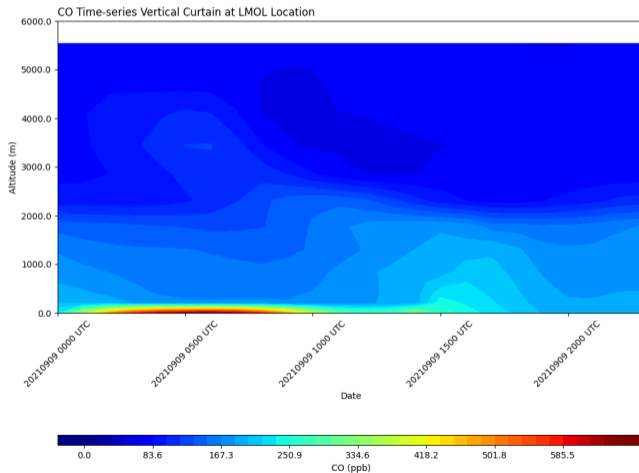
The case of September 9 – Observation and GEOS-CF modeling



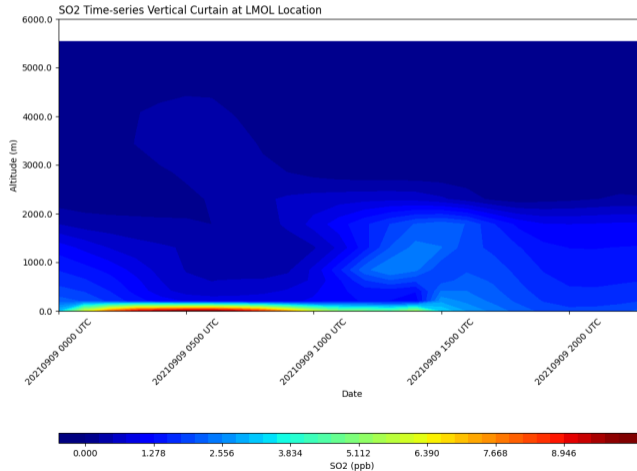
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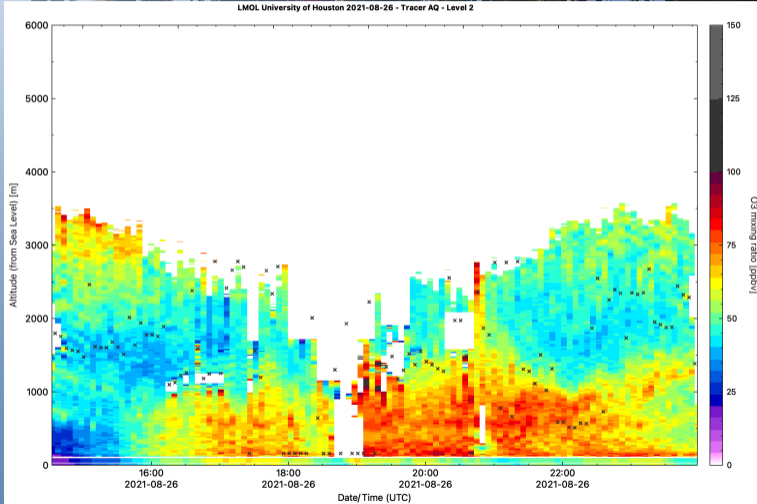
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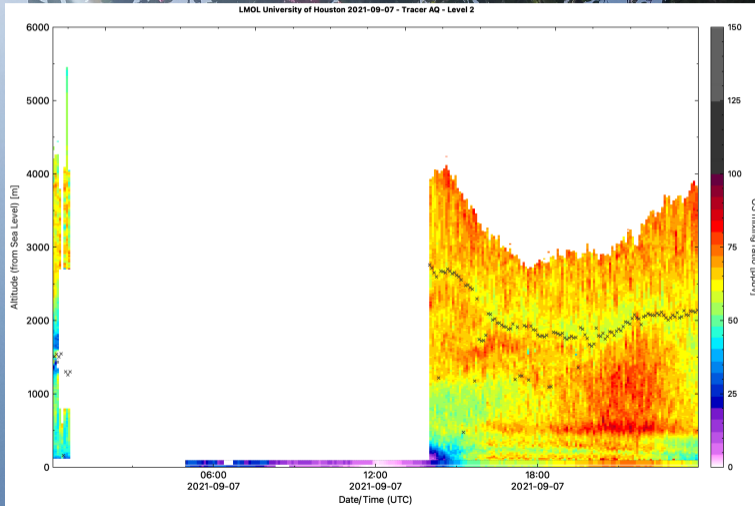
The case of September 9 – Observation and GEOS-CF modeling



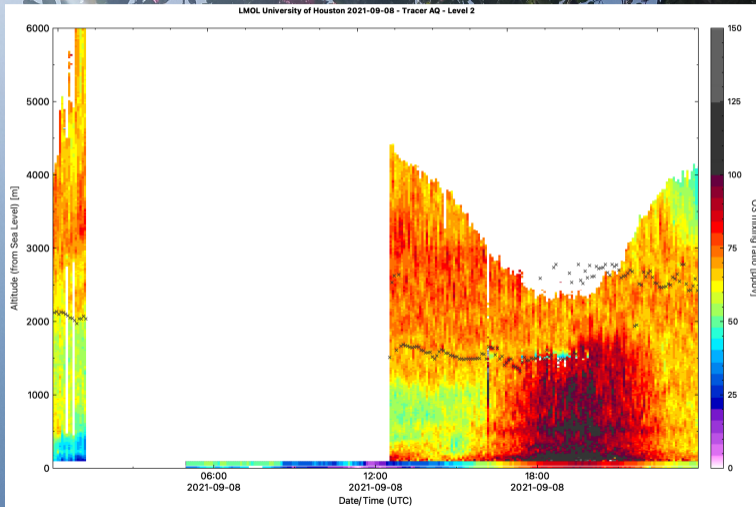
Action days: O₃ or pollution event



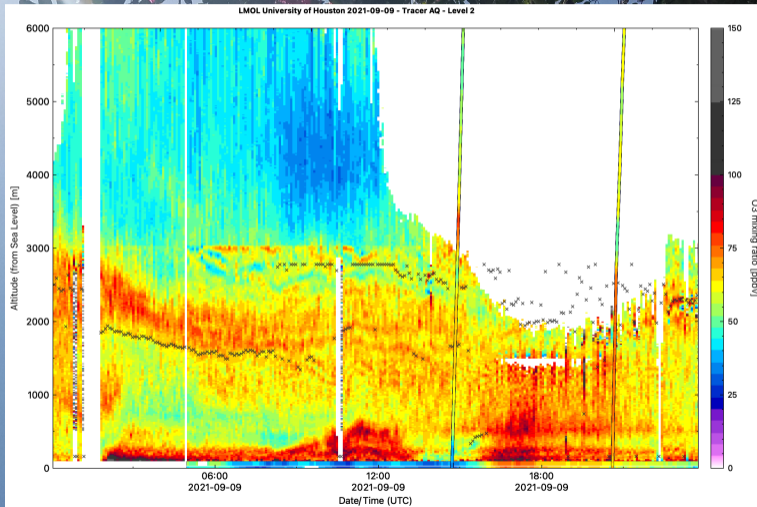
Action days: O₃ or pollution event



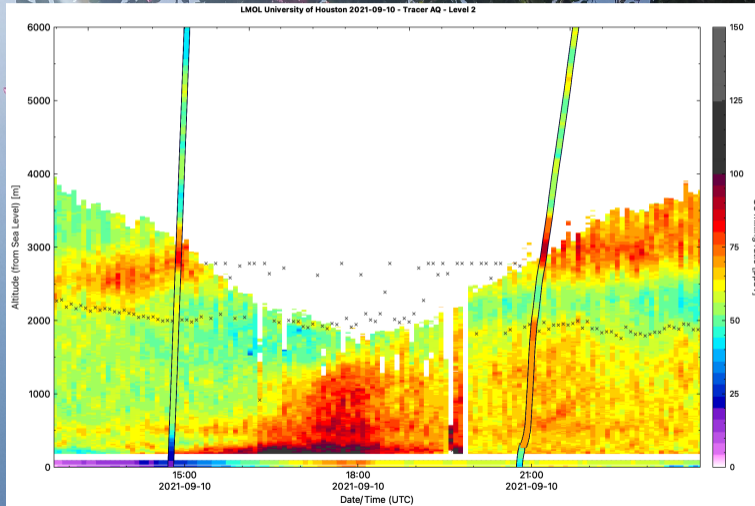
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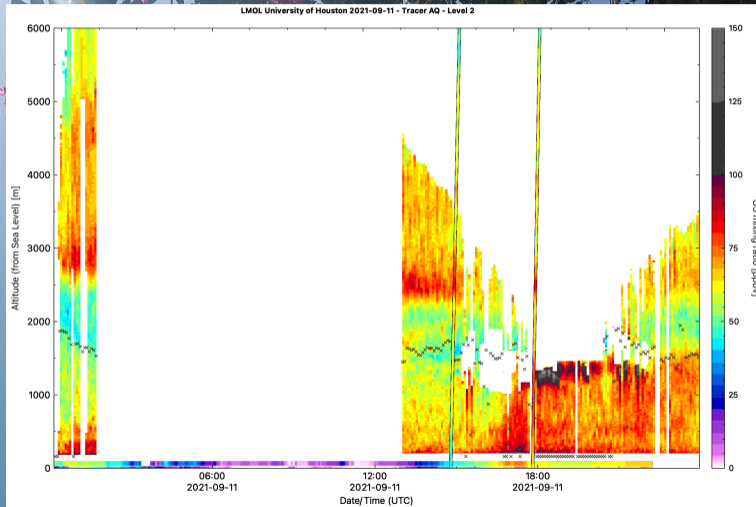
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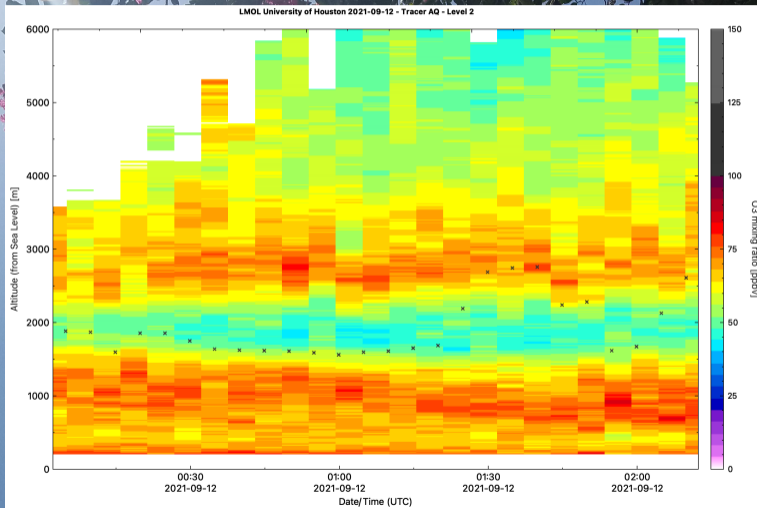
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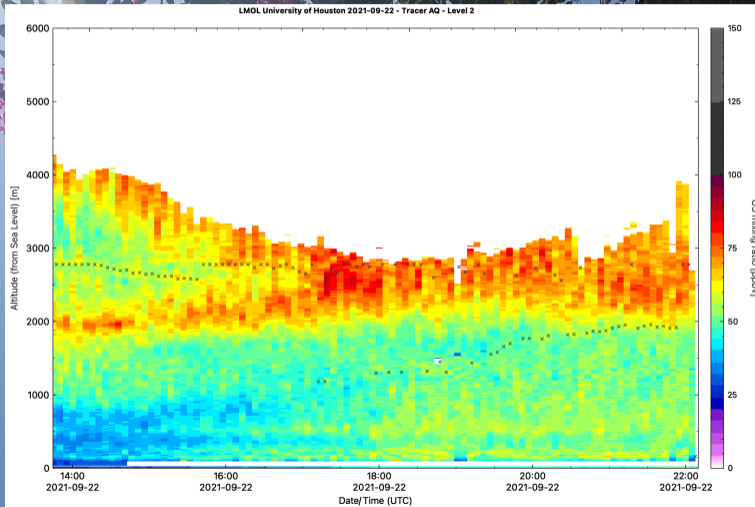
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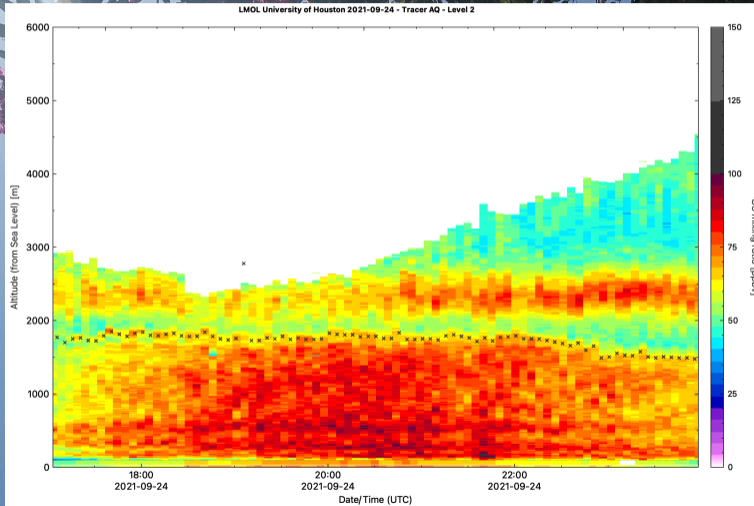
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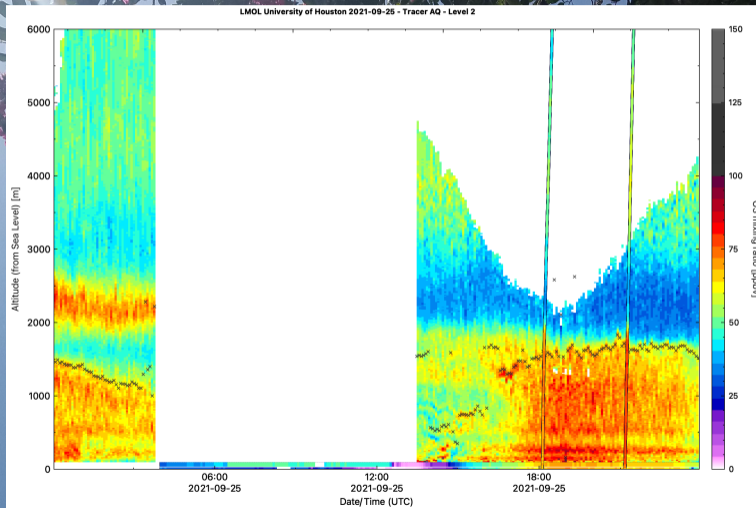
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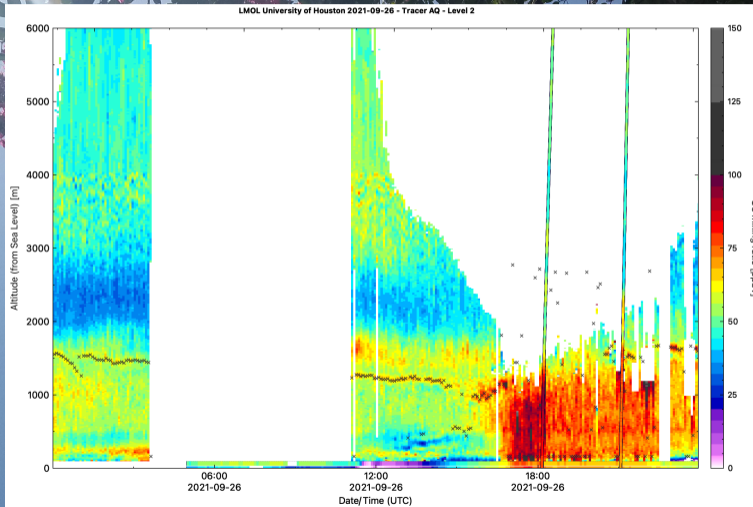
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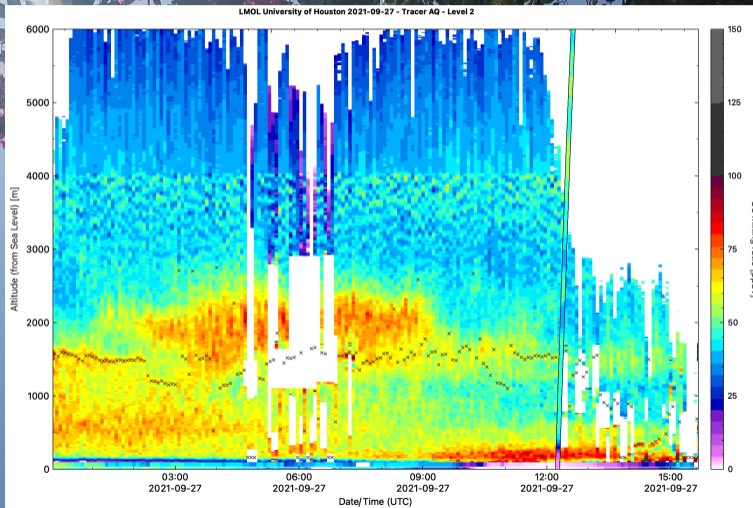
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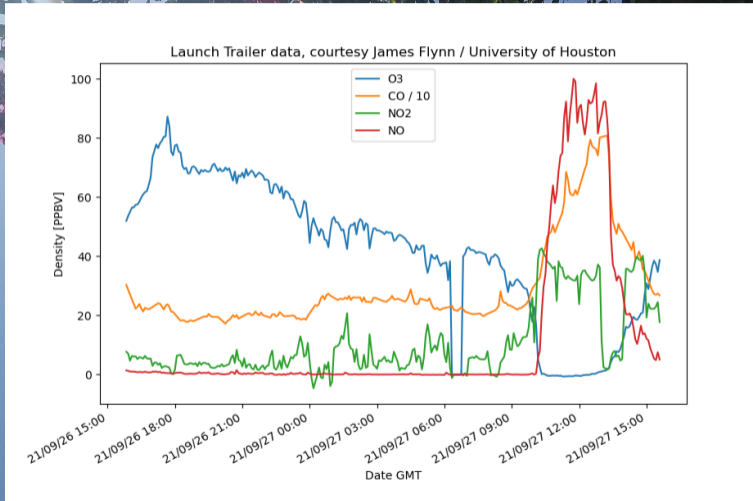
Action days: O₃ or pollution event



High pollution event (Traffic / Industry)



High pollution event (Traffic / Industry)



Discussion / Conclusions

2019-02-14 SI

- The TRACER-AQ campaign allowed the observation of an heavily polluted and humid environment
- LMOL was able to observe high O_3 concentrations
- The aerosol correction has proven being an important asset for this campaign
- High SO_2 , NO , NO_2 events are observed near the ground, suggesting local pollution (traffic, industry)

Questions?



G. GRONOFF

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